FERRIS

FERRIS INSTRUMENT COMPANY

Boonton, N. J.

MADE IN U.S.A.

OPERATING INSTRUCTIONS FOR THE FERRIS
MODEL 22A SIGNAL GENERATOR

PURPOSE:

The Model 22A Signal Generator is a source of variable radio frequency voltage for use in testing radio receivers and other apparatus. This voltage can be varied continuously from a fraction of a microvolt to 1 volt. Its frequency can be varied continuously from 85 to 25,000 kilocycles. It can be modulated up to 50% in depth by a self-contained 400 cycle oscillator or at other audio frequencies by an external oscillator. Frequency is controlled by a direct reading dial with a vernier control dial divided into 100 equal parts providing a total of 500 divisions for more precise settings.

INSTALLATION:

Shipment is generally made with all tubes in place and the instrument is ready for operation as received. This instrument operates on A. C. only, at frequency and voltage as shown on the name plate located on the case below the power cord. Do not operate on any other voltage or frequency. Never attempt to operate from a D. C. supply line.

For export shipment some or all of the tubes may be removed. They may be replaced by removing the back cover of the case. The following is a list of all tubes:

VR90	Voltage Regulator (extreme right in power unit)
5Y3GT	Rectifier (power unit)
6J5	Modulator (modulator unit)
955	R. F. Oscillator (inside copper shield)
76	Vacuum tube voltmeter (tube shelf at left)

Plug cord into proper line supply and operate toggle switch to "On" position. R.F. Voltage meter should indicate output under control of knob below it to the left.

FREQUENCY CONTROL:

Carrier frequency bands are controlled by the large knob marked A.B.C, etc. The band in operation is indicated by the letter at the top of the knob. Frequencies corresponding to each range are shown on the direct reading dial. Closer settings, as required for selectivity measurements, can be obtained by use of the 100 division vernier dial. This dial revolves five times for each range, each revolution being indicated by the inner scale of the large dial. This makes a total of 500 divisions for more precise calibrations than are possible with the direct reading dial. For example: 250 on a calibration table would indicate that the direct reading dial be set to 2 and the vernier dial to 50. Selectivity tables for certain frequencies are supplied with the instrument. Similar tables for other frequencies can be prepared by the user or will be supplied by the maker if ordered when the instrument is purchased.

OUTPUT VOLTAGE:

The R.F. output meter should be set to 1.0 by the R.F. control below the meter at the left. With the output meter at 1.0, the output voltage in microvolts at the output binding posts is determined by the settings of the "Multiply-By" switch, times the setting of the "Microvolts" dial. The output resistance across which this voltage appears varies with the settings of the controls, and is as follows:

Multiply by 100 K	(up to 1 volt)	Variable 0 to 100 ohms
Multiply by 10 K	(up to 0.1 volt)	100 ohms
Multiply by 1 K	(up to 10,000 uv)	10 ohms
Multiply by 1,10 or 100	(up to 1,000 uv)	5 ohms

In using this generator, consideration should be given to the impedance of the load; if it is low enough to shunt the output resistances appreciably, the output voltage will be reduced accordingly. For instance: a two hundred ohm impedance would not shunt the "Multiply by 1K" seriously, but would reduce the voltage of the "10K" step considerably. This condition might result in an inability to check results on these two steps.

The output meter is a V.T.V.M. It should be set to zero by the "Adjust Zero" control, with the R.F. control potentiometer rotated all the way counter clockwise. It will be necessary to readjust this control occasionally.

MODULATION:

With the modulation switch at "Int." the 400 cycle internal oscillator is connected to the modulation circuit. In the "Ext" position, the modulating voltage is obtained from an external source through the "Ext Mod" binding posts. The load impedance presented to the external oscillator is of the order of 5,000 ohms, and the oscillator should be capable of maintaining about 35 volts across this load for 50% modulation. Per cent modulation is indicated directly by the modulation meter. This meter is a rectifier type meter, corrected for frequency up to about 12,000 cycles. The depth of modulation is regulated by the potentiometer underneath this meter.

LINE FILTER:

Due to the filter condensers from each side of the AC line to the case, a small spark may be noticed when a grounded lead is connected to the case or to the ground terminal; or, a shock may be felt if the case, while ungrounded, is touched at the same time as a grounded object. It is usually advisable to ground the microvolter case to avoid the possibility of shocks as mentioned.

A more detailed description of the effects due to presence of the filter condensers will be found in Instruction Sheet FYB-2, "Notes on the use of AC Operated Microvolters," which should be consulted before attempting to measure AC-DC types of receivers, as special precautions are necessary in such cases.

MAINTENANCE

DISCREPANCIES IN OUTPUT VOLTAGE:

This may be due to defective resistors in the step attenuator. The operation of this attenuator can be checked as follows: Connect, through the usual dummy antenna, to a receiver, preferably one in which the automatic volume control has been replaced by a manual control. Set the Microvolter for 10 microvolts output (Microvolts dial at 10, switch at "Muliply by 1"), tune the receiver and adjust the volume control to give a suitable output as shown on an output meter connected to the receiver. Then set the "Microvolts" dial to zero and the switch to "Multiply by 10", and increase the output dial setting until the same output is obtained as before. The dial should, of course, read 1.0 (since this would give 10 microvolts indicated output as before). Reset output meter to 1.0 and retune when necessary. Similar checks can be made between other attenuator steps at 100 and 1000 microvolts, etc., by reducing the receiver sensitivity at each voltage level as required. These tests check the attenuation of each successive step in the attenuator. Of course, the receiver gain must be steady during this test and, if line voltage or anything else varies, the test should be repeated. At the higher levels a series resistance should be used large enough to insure that the receiver input resistance will not appreciably shunt the attenuator resistances shown in paragraph "Output Voltage."

These checks in general should be made at the lower frequencies (below 5 megacycles), as some small errors are to be expected at the higher frequencies.

NOISY ATTENUATOR:

The "Microvolts" dial controls a non-inductive wire-wound potentiometer. This control should be lubricated occasionally with vaseline. It can be reached for this purpose by removing the round cover plate, which is held only by friction. If the potentiometer should become noisy, it may be cleaned and relubricated. If it becomes badly worn through long usage, a replacement can be obtained from the maker, or the instrument can be returned for repair.

OUTPUT METER:

The output meter should read zero, with the R.F. voltage control set all the way to the left, or with the coil switch set between points. This meter is a diode type of vacuum tube voltmeter, and the zero adjusting screw located below the meter to the right controls the biasing voltage for balancing out the initial current. If the meter cannot be adjusted to zero, trouble is indicated. A reading higher than zero indicates a failure of this biasing voltage due to an open resistor or connection or, possibly, a failure of entire B+ supply. A reading below zero indicates excessive biasing voltage, perhaps due to the failure of the biasing potentiometer. Look for defective contact. This condition may be due also to a bad voltmeter tube. See if the tube is operating, note if it is warm.

The output meter can be checked with a vacuum tube by measuring the output voltage at 10 x 100K microvolts (equals 1 volt), with modulation turned off. The sensitivity of this meter is controlled by a small potentiometer located on the VTVM tube shelf inside the instrument to the left, which can be reached by removing the back cover. This potentiometer should not be readjusted unless the user thoroughly assures himself that the output meter has become inaccurate.

OTHER TROUBLES:

The above paragraphs describe the troubles most likely to occur. The schematic diagram and list of parts furnished shows values of components of the circuit, which should be helpful in locating other troubles should they occur. The B+ supply should be about 90 volts measured at the B+ terminal on the modulation unit. Heater voltage should be about 6.3 volts AC at "A" terminal.

ADDITIONAL INFORMATION:

If any difficulty is experienced in the operation of this instrument, please write to the Ferris Instrument Company, Boonton, New Jersey, giving the serial number and describing the difficulty experienced in as much detail as possible, giving frequency, voltage levels, etc., at which trouble occurs.

In the event that trouble which the user cannot locate and clear should develop he may ship the instrument to Boonton without waiting for authorization to do so, following with a letter containing details of the trouble and the repairs desired. Address:

FERRIS INSTRUMENT COMPANY
Boonton, N. J.
U.S.A.

NOTES ON THE USE OF A.C. OPERATED MICROVOLTERS AND SIGNAL GENERATORS

Microvolters and Signal Generators are frequently damaged through carelessness in their use.

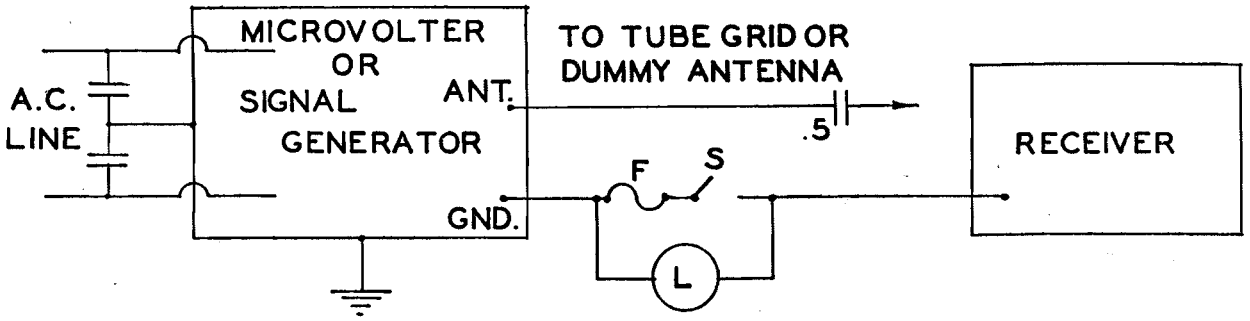
AC operated instruments should never be connected to a DC source of power.

The case should be grounded to avoid shocks to the operator. If this is not done the case will be above ground potential due to the filter condensers connected across the power line as shown in the figure.

The output of the attenuator should never be connected to a voltage source, AC or DC, high enough to damage the attenuator resistors (not over 3-4 V.) Trouble is most likely to be encountered in testing AC-DC receivers.

To avoid trouble when testing AC-DC receivers .5 mfd. condensers can be used in the antenna and ground connections between generator and receiver. This has a negligible effect on radio frequency but serves to block any direct or low frequency current. If severe hum is heard it is probable that the ungrounded side of the power line is connected to the receiver chassis and the receiver line plug should be reversed to correct this.

In some few cases, especially when it is necessary to connect the output of the microvolter to a tube grid instead of to the antenna lead of the receiver, some hum will still be left. The only satisfactory remedy in this case is a direct connection between the grounded Microvolter case and the receiver chassis with proper safe guards as shown in the figure.



F is a small fuse, preferably $\frac{1}{8}$ ampere size.

L is a 110 volt electric light bulb, preferably about 40 watt.

S is a small switch.

When connections are made as above plug the receiver into the line with the plug in one direction then in the other while the switch **S** is **OPEN**. With the plug in one way the lamp will light showing that the "hot" or ungrounded side of the line is connected to the receiver chassis. Do not leave the plug in this position but reverse it so that the lamp does not light. This shows that the grounded side of the line is connected to the receiver chassis and the Switch **S** can then be closed and measurements made.

FERRIS INSTRUMENT COMPANY
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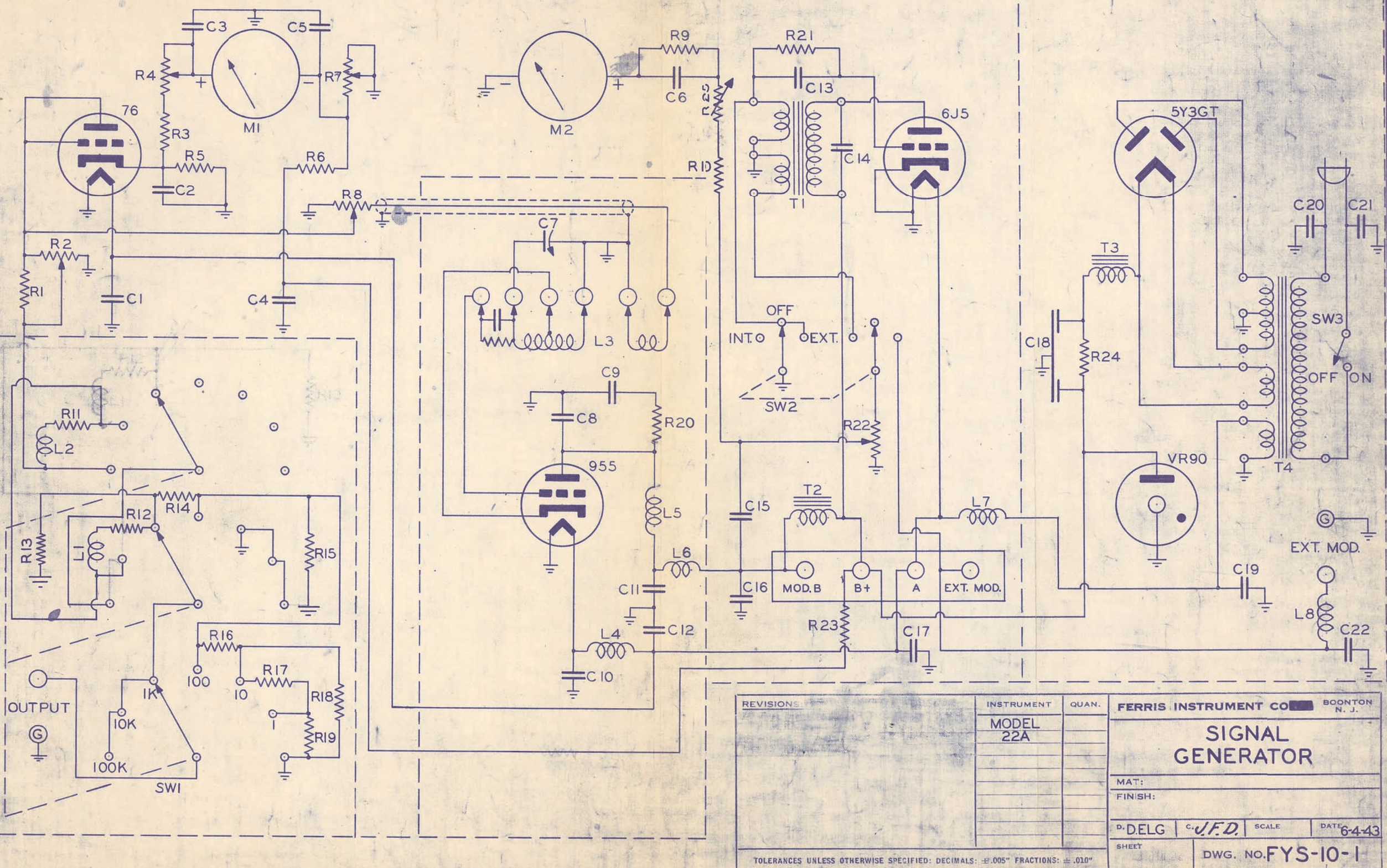
U.S.A.

SCHEMATIC No.	OUR PART No.	DESCRIPTION
C 1, 2, 9, 10, 12, 17, 19	CH-50	.1 mfd.
C 3, 5, 20, 21	CH-1	.01 mfd.
C 4, 13	CH-49	.01 mfd.
C 6, 11, 16	CM-42	500 mmfd.
C 7	FCV-21	Variable Tuning
C 8	CM-44	.001 mfd.
C 14	CH-13	.5 mfd.
C 15	CH-46	1.95 mfd.
C 18	CE-13	10-10 mfd.
C 22	CM-39	200 mmfd.
R 1	RC-30	1,000 ohms
R 2	FRV-37	130 ohms Potentiometer
R 3	RC-36	4,500 ohms
R 4	RV-51	2,500 ohms Potentiometer
R 5	RC-49	50,000 ohms
R 6	RC-74	15,000 ohms
R 7	RV-45	200 ohms Potentiometer
R 8	RP-11	5,000 ohms
R 9, 10	RC-43	15,000 ohms
R 11	RC-132	900 ohms
R 12	RC-131	90 ohms
R 13	FRW-63	12.5 ohms
R 14	FRW-67	45 ohms
R 15, 19	FRW-61	5.5 ohms
R 16, 17	FRW-65	49.5 ohms
R 18	FRW-62	6.11 ohms
R 20	RC-37	5,000 ohms
R 21, 23	RC-32	2,000 ohms
R 22	RV-10	20,000 ohms Potentiometer
R 24	RW-128	2,500 ohms
R 25	RV-25	10,000 ohms Potentiometer
L 1	FALR-7	Compensating Coil
L 2	FALR-8	Compensating Coil
L 3		R. F. Oscillator Coil
L 4	FLR-13	Choke Coil
L 5	FALR-6	Choke Coil
L 6, 8	FLR-12	Choke Coil
L 7	FLC-4	Choke Coil
T 1	FAU-56	Audio Oscillator Transformer
T 2	FAU-55	Choke Coil
T 3	LC-9	Choke
T 4	LP-21	Power Transformer
SW 1	FHR-10	Section Switch, Attenuator
SW 2	HR-9	Rotary Switch, Modulation
SW 3	HQ-7	Toggle Switch
M 1	FBM-60	R. F. Voltage Meter
M 2	FBM-56	Per Cent Modulation Meter



REVISIONS	INSTRUMENT	QUAN.
	MODEL 22A	

TOLERANCES UNLESS OTHERWISE SPECIFIED: DECIMALS: ±.005" FRACTIONS: ± .010"

FERRIS INSTRUMENT CO. BOONTON N. J.

SIGNAL GENERATOR

MAT:

FINISH:

D. D.ELG	C. J.F.D.	SCALE	DATE 6-4-43
SHEET	DWG. NO. FYS-10-1		